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ABSTRACT

This study sought to determine effective instructional practices for hearing-impaired students in mainstreamed and special classes. It involved a survey of 63 secondary mathematics teachers (with an 87% response rate), teacher logs of assignments and class work, and live observations. The study found no main effect for type of classroom (mainstreamed or special), achievement level of the class, or for 10 classroom process variables (such as positive feedback, homework frequency, and degree of individualization.) There was no interaction effect for the type of placement and the level of achievement. There was an interaction between the type of placement and the process variables, but no interaction effect between process variables and achievement. It appeared that successful mainstream placement may be defined by a greater degree of oral presentation and less seatwork, while a successful special class may be defined by less teacher talk and more seatwork. It is concluded that effectiveness was not found to be identical in the two situations, but the specific differences could not be clearly established. (14 references) (JDD)

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Effective Teaching of Hearing Impaired Students in Different Environments

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RATIONALE

Setting differences between mainstream and special classrooms are readily apparent on several dimensions including student ability, class size, instructional purpose, and to a certain extent, subject matter (Wolk et al., 1982; Moores et al., 1985). Hearing impaired students in these different kinds of classrooms may vary on the basis of age, sex, race, ability, and degree of hearing loss (Wolk et al., 1982). Several studies (Wolk et al., 1982; Allen and Osborne, 1984; Moores et al., 1985) have shown that only the more academically able hearing impaired students are mainstreamed in subject matter courses and that they are mainstreamed into very specific types of courses. On the classroom level, there are obvious differences between mainstreamed and special classrooms. Mainstream classes are larger and tend to be group and subject matter oriented while special classes for the hearing impaired tend be smaller, should use more individual forms of instruction, and should emphasize individual achievement (Kluwin and Moores, 1985).

We might expect to find several categories of potential process differences including the distribution of class time across tasks, the teacher's verbal style including the rate of questioning and the type of feedback provided, the group structure of the class, that is, large group, small group or individual orientations, and rates of progress through the curriculum such as the level of content demand, the frequency of testing or the frequency of homework (Walberg, 1984). Age or ability of the students influences the content demand of the lessons, the pace through the curriculum, and to some extent the verbal behavior of the teacher (Gregory and Osborne, 1975). Class size interacting with instructional purposes influences the group orientation and the degree of individualization of the classroom (Fisher et al., 1981).

A specific example of the relationship of classroom size and classroom process differences can be found in a study by Bourke (1986) who looked at 63 elementary grade level mathematics classrooms which varied in the number of students in each classroom. He found that teaching practices changed in relation to class size. Specifically, he reported that as the size of the class increased, the use of whole class teaching, teacher probing following a response to a question, the correction of homework, and the use of oral testing decreased. As class size increased, the number of groups within the class increased as did the frequency of interactions between the teachers and students, the amount of tolerated noise, the amount of non-academic management time, and the amount of teacher lecturing to the entire class as a group.

The summaries of the effective instruction literature such as Walberg's (1984) or Berliner's (1982) suggest four general categories of process variables which may effect achievement in different settings: use of class time, teacher's verbal style, group orientation, and the rate of progress through the curriculum. We can use these general categories to organize the possible range of specific process

variables.

Since the purpose of the placement and the characteristics of the students differs between the two types of placements, we should expect process differences between the two placements. Specifically, ability differences should produce differences in the pace through the curriculum and possibly in some of the teacher's verbal behavior (Larrivee, 1982). Generally, as class size is reduced, group orientation should shift toward the individual (Bourke, 1986). Consequently reductions in class size should be reflected in more time devoted to individual student concerns and to small group or individual classroom structure. Changes in subject matter can result in verbal process differences, in the rate of progress through the curriculum, the use of class time and even group structure (Evertson et al., 1980).

This study describes effective instructional practices for hearing impaired students in mainstreamed and special classes. Since mathematics classrooms are the situation where hearing impaired students are most likely to be mainstreamed (Wolk et al., 1982; Moores et al., 1985), mathematics was selected for study to provide the largest pool of subjects.

METHOD

Sample

Students. There were 215 students from eleven school districts around the United States in this study. The average age of the students was 16.7 years (s.d. = 1.6 years). 60.8% of the students were White; 17.5% were Hispanics; 16.6% were Black; and 4.8% were other minorities. 44.1% of the overall sample was male and 55.9% was female. The average hearing loss was 88.3 dB in the better ear with a standard deviation of 20.2 dB. This would put most of the sample in the severe to profound range. There were more non-white students and fewer severely impaired students in this sample than would be expected in a national population of hearing impaired students in public school programs. This discrepancy may be a function of the selection process.

The selection process for participation in this study resulted in the exclusion of the extremes of the population and did not completely control for between group differences. Remaining differences between the two groups were adjusted for in subsequent computations by using statistical controls.

Teachers. 63 teachers participated in the study. The average number of years of teaching experience for the overall sample was 14.4 years. 68.3% of the sample was white and 31.7% were black. No other minority groups were identified, but given the numbers of teachers involved in the study this is not unexpected. Most of the teachers were female, 63.4%, with 36.6% of the sample being male. There were differences between the regular class teachers and the teachers of the deaf in that the regular class teachers had a higher percentage of male teachers, a higher percentage of non-white teachers, and were more likely to be certified as teachers of mathematics.

Instrumentation

Teacher survey. A teacher opinion instrument developed by Good (1981) for use with both elementary and secondary school teachers of mathematics was shortened to 60 multiple choice and open ended items to reflect concerns appropriate only to high school teachers of mathematics. The purpose of the survey was to solicit information about activities such as planning and classroom reward systems which are not readily available from live observations. The return rate for the survey was 87%.

Teacher logs. In order to get a sense of the quantity and level of the work that the teachers demanded of their classes, they were asked to keep logs of their assignments and class work. The average number of days over which data was available was 21.3. The median number was 24.

The logs were coded according to the difficulty level and number of problems that were worked for that day. The coding convention counted all of the problems that the student did by himself or herself in class that day including seatwork, tests, quizzes, and homework.

There were 14 levels of coding ranging from simple arithmetic operations to trigonometry. The thirteenth category included special topics such as statistics, probability theory, or computer programming. All geometry topics were coded in the fourteenth category, but these few students were not included in this analysis because of the considerable differences in content between geometry and other mathematics content.

The coding scheme was developed on the basis of the tables of contents of the textbooks used, that is, the categories were operationally defined in advance based on the topical sequence of six widely used Algebra and General Mathematics texts. The textbook pages were then assigned a category number based on the topic covered.

Live Observation System. The classroom observation system was a data collection procedure which provided a record of activities that occurred in the classroom, the interactions between teachers and students, and the function of the interpreter in the classroom. A time-series sampling observation system was designed to be sensitive to different instructional methods, interpersonal interactions, and classroom environments. The instrument was an adaptation of the SRI Secondary Observation Instrument (Stallings, Needels & Stayrook, 1979).

The first section of the classroom observation instrument was the classroom snapshot. The snapshot yielded data about the nature of the activities of each adult and student in the classroom, the size of the groups, and the materials being used. From this section, information was obtained on how the teacher spent his or her time and with whom, how often the students operated independently, and the instructional activities that occurred. The types of instructional materials that were used in the classroom were also recorded.

By crossing the four categories of activity, materials,

focus person, and group structure, it was possible to describe in considerable detail what occurred in the classroom. For example, it would be possible to record a teacher disciplining a single hearing student while the interpreter tutored a deaf student, and the rest of the class worked individually or in small groups at a specific task.

The second section of the live observation instrument was the five minute interaction which was used to observe teachers and students in group interactions or working alone. The categories consisted of who the speaker was, who the audience was, the topic of the communication, and the emotional or rhetorical valence of the remark. By crossing the four categories, several different types of interactions could be coded.

The observers were eleven trained teachers of the deaf who were brought to Gallaudet University for three days of training which included explanation of the system, practice coding with videotaped lesson segments, and actual classroom observations.

Five sets of snapshots and 5 FMI's were to be completed during each class period. There was up to a five minute rest period between each coding period of five minutes.

RESULTS

Teacher Survey. The attitudinal items from the teacher survey were factor analyzed to yield four factors: Individualization of instruction (alpha =.886); Instructional flexibility (alpha =.713); Rule flexibility (alpha = .567); Inductive teaching (alpha=.620); Student responsibilities (alpha =.624).

Validity for the teacher questionnaire was established by correlating specific teacher reports of classroom behavior with direct observation of teaching behavior based on the "Classroom Snapshot".

Live Observation System. The average number of observations per teacher was 3.2 with a range of from 1 to 8 observations. The larger numbers of observations resulted from teachers teaching more than one class. To deal with the variation in the number of minutes of observed time, all of the observations were weighted on the basis of 100 minutes of observed time per teacher. Rater reliability for the eleven observers for the classroom snapshot section was .942 using an alpha coefficient for the observation category totals aggregated for each observer. Rater reliability for the five minute interaction portion of the observation instrument was .663 for the original set of categories.

Demographic and Achievement Data. Data on the students' degree of hearing loss, etiology, onset of deafness, age, sex, and ethnicity was available through the Annual Survey of Hearing Impaired Children and Youth with the permission of the parents and the school programs. Achievement data was provided by the regular school administration of the Stanford Achievement Test Hearing Impaired Version. All of the students took this test in the spring at the end of the observations, however, because school collected data was

relied on, pre-testing dates varied for the students. Consequently the time gap between test administrations was adjusted for in all computations of achievement.

Many of the verbal process variables from the FMI inter-correlated with each other as well as with the categories generated by the Classroom Snapshot, consequently, only two of the verbal process variables were used in the subsequent analysis. Of the five factors from the teacher questionnaire, the two most reliable were selected.

To differences in effective teaching between the mainstreamed and the special classes, a two by three, repeated measures analysis of variance was computed for the ten classroom process variables described in Table 1. The independent variables were the type of classroom, mainstreamed or special, and the level of achievement in the classroom: high, mixed, or low. To create the achievement groups, individual regressed achievement scores were computed by regressing the pre-observation achievement score, race, sex, and time between test administrations against the post-observation achievement score. The achievement measures were the mathematics computation and the mathematics concepts sub-scale scores for the SAT-HI. Class average scores were then computed for each teacher. If a teacher had a class average regressed score on an achievement measure above the grand mean, then he or she was coded as a high achieving teacher for that subtest. This process yielded three types of teachers based on the class average regressed scores: high on both tests, low on both tests, high concept achievement with low computation achievement or low concept achievement with high computation achievement. To reduce the variance due to the use of different metrics, all of the dependent variables were converted to z-scores. The ANOVA was then computed on the z-scores.

To identify which of the variables in the repeated measures analysis of variance would contribute to the expected difference between the two types of placements, the difference between mainstreamed and special classes was also tested using an 'a priori' contrast for each of the dependent variables. Since some previous research had suggested that only high achieving classes were readily describable, a non-linear relationship might exist where only teachers high on both measures were significantly different from the other types. This secondary hypothesis was tested using an 'a priori' contrast between the high achieving special classrooms and the high achieving mainstreamed classrooms.

There was no main effect for type of classroom, achievement level of the class, or for the process variables. While no main effect for classroom type may be disappointing, it is understandable if the direction of the differences are not consistent across the different process variables, a result that would be expected. The lack of a main effect for achievement is not unexpected since other research had only been able to identify consistent results for high achieving classes. A main effect for the differences between the process variables would not be expected because the different

metrics had been converted to z scores.

There was no interaction effect for the type of placement and the level of achievement. This would be consistent with previous research such as Allen and Osborne (1984) which had found statistically significant but small effects for very large numbers of individuals. There was an interaction between the type of placement and the process variables ($F=14.46$, $df=4,160$; $p<.001$). There was no interaction effect between the process variables and the achievement of the class. The three way interaction of the achievement of the class by the type of placement by the process variables was not statistically significant.

Mainstreamed classes are distinguishable from special classes on the basis of the greater frequency of oral presentations by the teacher, by a greater use of positive verbal feedback, by more time devoted to instructing the whole group, and by a higher level of content demand (See Table 2). Special classes use more seatwork, more frequent questions, and a greater degree of individualization than do mainstreamed classes. High achieving mainstream classes make greater use of oral presentations by the teacher while high achieving special classes have the least amount of teacher oral presentation time. High achieving mainstreamed classes used the least amount of seatwork while high achieving special classes used the greatest amount of seatwork. High achieving classes, both mainstreamed and special, assigned homework more than the other classrooms.

Of the process variables which differ between the mainstream and the special placements, only two also showed differences for class achievement as well. What defines a successful mainstream placement from an unsuccessful one is a greater degree of oral presentation and less seatwork. What describes a successful special class is less teacher talk and more seatwork.

CONCLUSION

The results of this study must be interpreted with some limitations. As a result of the selection process followed by schools in making decisions about educational placements for hearing impaired students, comparisons between groups drawn from different placements must involve some kind of a correction factor. The adjustments necessary in this study to establish roughly comparable groups resulted in the elimination of the extremes of the population, hence generalizability is limited. To control for age and subject matter differences, secondary school mathematics was studied. Again generalizability beyond that population is problematic. To avoid the mode of communication complication inherent in studies of hearing impaired populations, only total communication situations were studied, therefore conclusions applied to other communication situations should be tentative at best.

Like similar studies, this study found that the relationship between setting, process, and outcome is difficult to clearly establish. As would be expected, the primary

finding was that mainstream classes use large group processes while special classes use more individualized processes. Effectiveness was not found to be identical in the two situations, but the specific differences could not be clearly established. The failure to lay an unequivocal track of evidence from setting differences to process differences to achievement may lie in the relatively small number of classrooms examined. Nonetheless, effective teaching in one setting is not necessarily identical to effective teaching in another setting. Recommendations for placements for hearing impaired children should be based on the characteristics of the child and the quality of the setting, a concept which this study has shown can be open to a more complex interpretation (Snow, 1987).

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Table 1
Operational Definitions of Process Variables

Category	Variable	Operational Definition
Use of Class Time	Teacher oral presentation	Three fourths of class time is an oral presentation by teacher
	Seatwork	Amount of time class spends
Verbal Style	Question pace	Frequency of teacher asking questions
	Positive feedback	Frequency of teacher praise or positive response to students
Group Orientation	Degree of individualization	Teacher questionnaire factor score
	Instructional flexibility	Teacher questionnaire factor score
	Tutorial time	Amount of class time spent in teaching one student
	Whole group instruction	Amount of class time where teacher presents to entire class as a group
Progress through the Curriculum	Content demand	Cognitive level of material covered
	Homework frequency	Number of days per week homework is given

Table 2
'A priori' Contrasts for Process Variables

Variable	T Values for Contrasts ($p < .01$) Mainstreamed vs. Special Placement	Achievement by Placement Interaction
Teacher oral presentation	3.225	-2.707
Seatwork	-3.915	4.913
Question pace	-5.906	---
Positive feedback	4.518	---

Degree of individualization	-10.170	---
Instructional flexibility	---	---
Tutorial time	---	---
Whole group instruction	5.946	---
Content demand	5.387	---
Homework frequency	---	2.776